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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/715,017

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Arun Majumdar

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BUCHANAN, INGERSOLL & ROONEY PC  
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EXAMINER

LUM, LEON YUN BON

ART UNIT

PAPER NUMBER

1641

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

01/04/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/715,017

Applicant(s)

MAJUMDAR ET AL.

Examiner

Leon Y. Lum

Art Unit

1641

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 04 October 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 64-109 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 64-109 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 4, 2006 has been entered.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 90-91 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. In claims 90-91, the phrase "the fluid cell" is vague and indefinite. Since parent claim 64 requires multiple fluid cells, it is unclear which fluid cell the claims are referring to.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 64-74, 77-79, 80, 82-87, 89, 92-102, 105-106, and 109 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sofield et al (US 2002/0072127 A1) (hereinafter "Sofield") in view of Ellerbrock et al (US 6,204,920 B1) (hereinafter "Ellerbrock") and Wohlstadter et al (US 6,066,448) (hereinafter "Wohlstadter").

Sofield teaches an array of micro-cantilever structures (i.e. an assembly comprising an array of microsensors; reflective, flat paddle), each micro-cantilever structure being immersed in a respective vessel of liquid (i.e. individual fluid cell for each of the microsensors), and each vessel comprising both silicon wafer and a glass bottom surface (i.e. a silicon portion and a glass portion forming the individual fluid cell). See pages 1-2, paragraphs 0010 and 0022; and Figure 3. Sofield also teaches that each micro-cantilever structure has a coating of receptor molecules thereon for identifying specific ligands in a sample solution (i.e. functionalized to deflect when exposed to target molecules). See page 1, paragraphs 0003 and 0004. Sofield further teaches a laser diode (i.e. optical beam source) and a quadrant photodiode (i.e. optical detector). See page 2, paragraph 0021 and Figure 2.

However, Sofield fails to teach that the optical beam source is a single optical beam source configured to simultaneously direct an optical beam onto each of the microsensors in the array of microsensors and that the optical detector is an optical detector array configured to simultaneously detect the position of each of the microsensors.

Ellerbrock teaches a single light source that is multiplexed, in order to address multiple sensors while reducing cost of the system with just one light source. See column 2, lines 19-31; column 4, lines 45-67; and Figure 2. In addition, Ellerbrock teaches that the light source can emit laser light. See column 5, lines 38-42.

Wohlstadter teaches a CCD array, in order to detect and spatially resolve simultaneous emissions of emitted light. See column 25, lines 38-46.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the laser diode of Sofield with a single light source that is multiplexed, as taught by Ellerbrock, in order to address multiple sensors while reducing cost of the system with just one light source. The advantage of producing an optical system for simultaneously emitting a plurality of light beams without requiring multiple light sources provides the motivation to combine the single light source of Ellerbrock with the apparatus of Sofield. In addition, one of ordinary skill in the art at the time of the invention would have had reasonable expectation of success in including the single light source in the apparatus of Sofield, since Sofield teaches laser light sources, and the single light source of Ellerbrock is also a laser light source.

It would have also been obvious to one of ordinary skill in the art at the time of the invention to modify the optical detector of Sofield with the CCD array of Wohlstadter, in order to detect and spatially resolve simultaneous emissions of emitted light. The ability to simultaneously detect signals from a plurality of regions improves the efficiency of multiplexed assays, thereby providing the motivation to combine the teachings of Sofield and Wohlstadter. One of ordinary skill in the art at the time of the invention

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would have also had a reasonable expectation of success in combining the teachings of Sofield and Wohlstadter since Sofield teaches light detection and the CCD array of Wohlstadter is one type of sensor that can detect light.

In regards to claims 69, 85-87, and 97, Sofield teaches a transverse cross strip. See page 2, paragraph 0019 and Figure 1.

In regards to claims 72, 83 and 100, Ellerbrock teaches a coupler array 210 with parallel beams 212. See column 5, lines 43-50, and Figure 2.

In regards to claims 77 and 105, Wohlstadter teaches a different binding agent at each discrete binding domain, in order to perform a multiplexed assay. See column 5, lines 2-4.

In regards to claims 79 and 106, Sofield teaches that the light source can come from underneath the glass bottom. See page 2, paragraph 0022 and Figure 3.

In regards to claims 80 and 107, since an array with individualized fluid cells is involved, there necessarily needs to be a system to dispense fluid into the cells with the ability to control the amount.

In regards to claim 84, Sofield teaches that beam 28 hitting the bottom surface of the glass substrate at regions where micro-cantilevers are will be transmitted through, hitting the regions where the silicon layer is on top of the glass substrate will cause the beam to reflect.

In regards to claim 89, Sofield teaches that the micro-cantilevers can be made of silicon nitride. See page 1, paragraph 0006.

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9. Claims 75 and 103 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sofield, Ellerbrock, and Wohlstadter as applied to claims 64 above, and further in view of Quate et al (US 6,203,983) (hereinafter "Quate").

Sofield, Ellerbrock, and Wohlstadter have been disclosed above, but fail to teach that the optical detector array is a CMOS array.

Quate teaches a CMOS microelectric processing system, in order to easily integrate with silicon-based micromechanical devices such as cantilevers and to produce seamless sensors at low cost and integrate them directly into computers. See column 2, lines 11-23.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Sofield, Ellerbrock, and Wohlstadter with a CMOS microelectric processing system, as taught by Quate, because the CMOS detectors are low cost, can be easily integrated into computers, and can be utilized with silicon-based cantilevers. The ease of use and economic incentive provide the motivation to combine the teaching of Quate with the teachings of Sofield, Ellerbrock, and Wohlstadter. In addition, one of ordinary skill in the art at the time of the invention would have had reasonable expectation of success in including a CMOS system with a micro-cantilever structure array, since the CMOS system can be integrated with silicon-based cantilevers and the micro-cantilever structures are silicon-based.



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10. Claims 76, 81, 104, and 108 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sofield in view of Ellerbrock and Wohlstadter as applied to claims 64 and 92 above, and further in view of Lee et al (US 5,807,758) (hereinafter "Lee").

The teachings of Sofield, Ellerbrock, and Wohlstadter are disclosed above, but fail to teach that at least one microsensor that is not functionalized to deflect when exposed to the target molecules.

Lee teaches a reference cantilever 82 in proximity to a modified cantilever 12, in order to eliminate sources of noise, including non-specific binding. See column 8, lines 44-64; and Figure 8.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the micro-cantilever structures of Sofield, Ellerbrock, and Wohlstadter, by placing a reference cantilever in proximity to a modified cantilever, as taught by Lee, in order to eliminate sources of noise, including non-specific binding. This allows a clearer detection of sample binding on the functionalized micro-cantilevers, thereby providing motivation to combine the teaching of Lee with the teachings of Sofield, Ellerbrock, and Wohlstadter. In addition, one of ordinary skill in the art at the time of the invention would have had reasonable expectation of success in including the reference cantilever into the micro-cantilever structures, since both embodiments are the same type of device for the same purpose.

In regards to claims 81 and 108, Lee teaches that the cantilever can be detected using an interferometer. See column 8, lines 31-40.

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11. Claims 88 and 90-91 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sofield, Ellerbrock, and Wohlstadter as applied to claim 64 above, and further in view of Pfost (US 6,485,690 B1).

The teachings of Sofield, Ellerbrock, and Wohlstadter have been disclosed above, but fail to teach that the glass portion is polydimethylsiloxane (claim 88) and that the fluid cell has an inlet and an outlet and at least one channel having a through hole formed in the silicon portion of the assembly (claims 90-91).

Pfost teaches polydimethylsiloxane as a substrate layer, in order to provide a material that is moldable and compatible with the types of samples and reagent fluids used for biological assays. See column 16, lines 25-33. In addition, Pfost teaches a control and delivery system that provides fluids and reagents to each reaction well, in order to increase the efficiency and quantity of tests that can be performed simultaneously. See column 1, lines 22-62; column 6, line 47 to column 7, line 5; and Figure 9.

It would have been obvious to one of ordinary skill in the art at the time of the invention to replace the glass substrate of Sofield, Ellerbrock, and Wohlstadter with polydimethylsiloxane, as taught by Pfost, in order to provide a material that is moldable and compatible with the types of samples and reagent fluids used for biological assays. By having both beneficial characteristics of being moldable and biocompatible provides the motivation combine the teaching of Pfost with the teachings of Sofield, Ellerbrock, and Wohlstadter. One of ordinary skill in the art at the time of the invention would also have had a reasonable expectation of success in combining PDMS with the apparatus

of Sofield, Ellerbrock, and Wohlstadter, since the apparatus bottom is glass, and PDMS is one type of glass material.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the apparatus of Sofield, Ellerbrock, and Wohlstadter with a control and delivery system that provides fluids and reagents to each reaction well, as taught by Pfost, in order to increase the efficiency and quantity of tests that can be performed simultaneously. The benefit of increased efficiency and quantity allows a greater number of tests to be performed with automation, which provides the motivation to combine the teaching of Pfost with the teachings of Sofield, Ellerbrock, and Wohlstadter. One of ordinary skill in the art at the time of the invention would also have had a reasonable expectation of success in combining the control and delivery system with the micro-cantilever structures, since the structures are capable of handling small quantities of fluid and reagents, and the control and delivery system is optimized for small quantities of fluid and reagents.

### ***Response to Arguments***

12. Applicant's arguments with respect to claims 64-109 have been considered but are moot in view of the new ground(s) of rejection.

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13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leon Y. Lum whose telephone number is (571) 272-2878. The examiner can normally be reached on weekdays from 8:00am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Long Le can be reached on (571) 272-0823. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Leon Y. Lum  
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